The Use of Networks of Triangulatory Proximity Circuits to Detect and Characterize the Movement of Vehicles and Personnel in Urban Environments Without the Emission of Detectable EM or Acoustic Noise

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Introduction

Perhaps the most hazardous urban warfare activity is the clearing of buildings in contested territory. Important opportunities to retake unoccupied buildings may be missed as a result of not knowing whether a building is occupied by enemy forces. EM and acoustic-based technology already exists for the purpose of detecting movement through the walls of buildings, but these devices emit detectable noise that can expose friendly units.

Abstract

Proximity circuits may be adapted to create extrapolated three and four-dimensional maps of environments without the active emission of acoustic or EM noise provided that a sufficient number are deployed in a physical zone. An urban area may be blanketed from the air by these near-microscopic circuits released by bomblet dropped from an aircraft.

These circuits would number in the hundreds and would be coated with a mildly sticky substance that prevents them from being blown away. Each unit would consist of a trio of proximity circuits so that each unit would be capable of a degree of triangulation in its own right. When these trinary sensor units are used in conjunction with hundreds of others in an urban environment, subtle changes to electrical resistivity would register with these sensors in a predictable manner that would enable the circuits to be used to detect changes to the configuration of a physical environment.

Crucial to the successful deployment of these sensors is the ability to exfiltrate captured data without the detection of the network. The use of electromagnetism is eventually required absent the use of QE to exfiltrate data. As of this juncture, QE-based data exfiltration is not sufficiently miniaturized to facilitate that goal in the necessary form factor. Furthermore, QE-based exfiltration would blind the system to the crucial datapoint of sensor position relative to other sensors as well as its overall geospatial position. GPS could not be used as a broadcast signal would betray the presence of the network.

The requirement for non-detectability of of the sensor network as well as the need to know the relative position of all sensors necessitates the establishment of a novel method for securing short-range radio protocol to ensure non-detection of the individual sensor units (see subsequent publication for details.) This method, Bruteforced Directional Calibration in search of Nearest Neighbor

(BDCNN) enables unidirectional, short-range EM to be be emitted exclusively in the direction of a neighboring relay without the exact relative physical position of the units being known in advance. Each unit would attempt to send a signal in thousands of possible directions at separate times and each unit would be capable of triangulating received signals so that a return ping may be sent in the appropriate direction. When a return ping is detected, the directional calibration is semi-permanently fixed and signals are henceforth sent within the network only over short ranges and with a directional specificity of about 1/10th of one degree of angle.

This scheme ensures the minimization of risk of detection of the sensor network while remaining within the confines of what is achievable within the current SotA.

The sensors themselves would relay information concerning the angle at which their own signal is being transmitted as well as information concerning signal strength, enabling the position of each sensor within an urban environment to be known to within a certain margin of error sufficient, at least, to suggest which building is either occupied or not occupied. This extrapolation is comparable to a human being keeping track of the direction of their travel according to a compass and counting the number of paces they walk. Each time their direction changes, they make a note of it. With accurate record keeping, it is possible to determine where on a map one is by tracking direction and distance. This system achieves the same thing for electromagnetism as directionally confined signals hop from one relay to the next, utilizing only knowledge of direction and signal strength.

Conclusion

The ability to detect all movements within an urban environment without the emission of detectable EM could tip the scales in urban warfare scenarios, providing a critical advantage not likely to be anticipated by an adversary.